108-EMD-001

ECS Maintenance and Development Project

Program Management Plan for the EMD Project

September 2003

Raytheon Company
Upper Marlboro, Maryland

Program Management Plan for the EMD Project

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Preface

This document is a formal contract deliverable. It requires Government review and approval within 10 business days. Changes to this document will be made by document change notice (DCN) or by complete revision.

Any questions should be addressed to:

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Revision History

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Abstract

This document defines the Contractor's organizational structure, showing relationships and responsibilities for management and technical support through all phases of the contract life cycle. The plan summarizes how the work of the contract will be subdivided into work units, identifies the mid-level management positions, and describes the management of these work units. It contains sections for each of the major activities included in the Statement of Work, discussing how each will be managed.

Keywords: EOSDIS, EMD, Program-Management

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1. Introduction

1.1 Identification

This document is Item 008 of the Contract Data Requirements List (CDRL), whose requirements are specified in Data Item Description (DID) EMD-PMP-8 and is a required deliverable under the Earth Observing System Data and Information System (EOSDIS) Core System Maintenance and Development Contract (NAS5-03098).

1.2 Scope and Purpose

This document defines the Contractor's organizational structure, showing relationships and responsibilities for management and technical support through all phases of the contract life cycle. The plan summarizes how the work of the contract will be subdivided into work units, identifies the mid-level management positions, and describes the management of these work units. It contains sections for each of the major activities included in the Statement of Work, discussing how each will be managed.

1.3 Status

This document will be delivered once, 1 month after Task 101 award.

1.4 Organization

Section 1 describes the scope, purpose, status, and organization of the document. Section 2 describes other referenced or parent documents. Section 3 provides the EMD Program Management Plan information.

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2. Related Documentation

2.1 Parent Documents

The parent documents are the documents from which the scope and content of the EMD Program Management Plan are derived.

813-PL-028	EMD Statement of Work for Task 101, ECS SDPS Maintenance

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3. Program Management Plan

3.1 Internal Organization Structure, Staffing, Description of Work Flow through Contractor Organization, and Project Spending Rates

3.1.1 Internal Organization Structure

The key organizational elements include the following:

- The EMD contract, as an Indefinite Delivery/Indefinite Quantity (IDIQ) type contract, will be managed using both integrated product teams (IPTs) and cross product teams (CPTs).
  - An Integrated Product Team is integrated multidisciplinary team of people working together to meet common objectives and organized around a product or specific service. The IPT is responsible for the charter, budget, and planning within boundaries established by the program manager. The IPT Leader is accountable for cost, schedule, product performance, and quality. As such, the IPT owns the resources to perform the work. The IPT for SDPS Maintenance performs the specific service of sustaining engineering for all SDPS components. Each Task Order will form its own IPT, and may have subordinate IPTs within it to perform specialized functions. For instance, within the Sustaining Engineering IPT (Task 101), there will be teams to address custom code maintenance, COTS maintenance, operations deployment, and DAAC support (see Figure 3.1.1-1, EMD Organization).
  - Cross Product Teams (CPTs) are generally not responsible for developing deliverable products or a one time specific service. They normally provide similar services across many IPTs. Functions that apply to multiple tasks on the EMD Contract will be managed by CPTs. Resources from the IPTs make up the CPTs as necessary to perform these functions. The following teams will be providing support across all EMD Task Orders: Program Management, System Engineering and Integration Team/Architecture Review Board (ARB), Test and Integration, Software Installation, Configuration Management, and Infrastructure.
    - The Program Management Team, which provides management oversight during all task life cycle phases and ensures that adequate support services are available for all tasks. Each individual element of the PMT constitutes a small IPT for resource ownership and management.
    - The SEIT ARB CPT provides technical oversight over the SDPS architecture and design, ensures the integrity of the technical baseline, prioritizes incoming work, and optimizes resources and schedules across tasks.
    - The Test and Integration CPT manages the test facilities and oversees required performance, regression, and formal testing.

- The Software Installation CPT plans and executes installation processes and procedures across all tasks.
- The Configuration Management Team plans and executes CM processes and procedures across all tasks.
- The Infrastructure Team provides requested building infrastructure support across all tasks.

The EMD top-level organization is shown in Figure 3.1.1-1 and described in more detail below. It also includes the existing ECS IPTs to show the relationship to existing EMD staff.

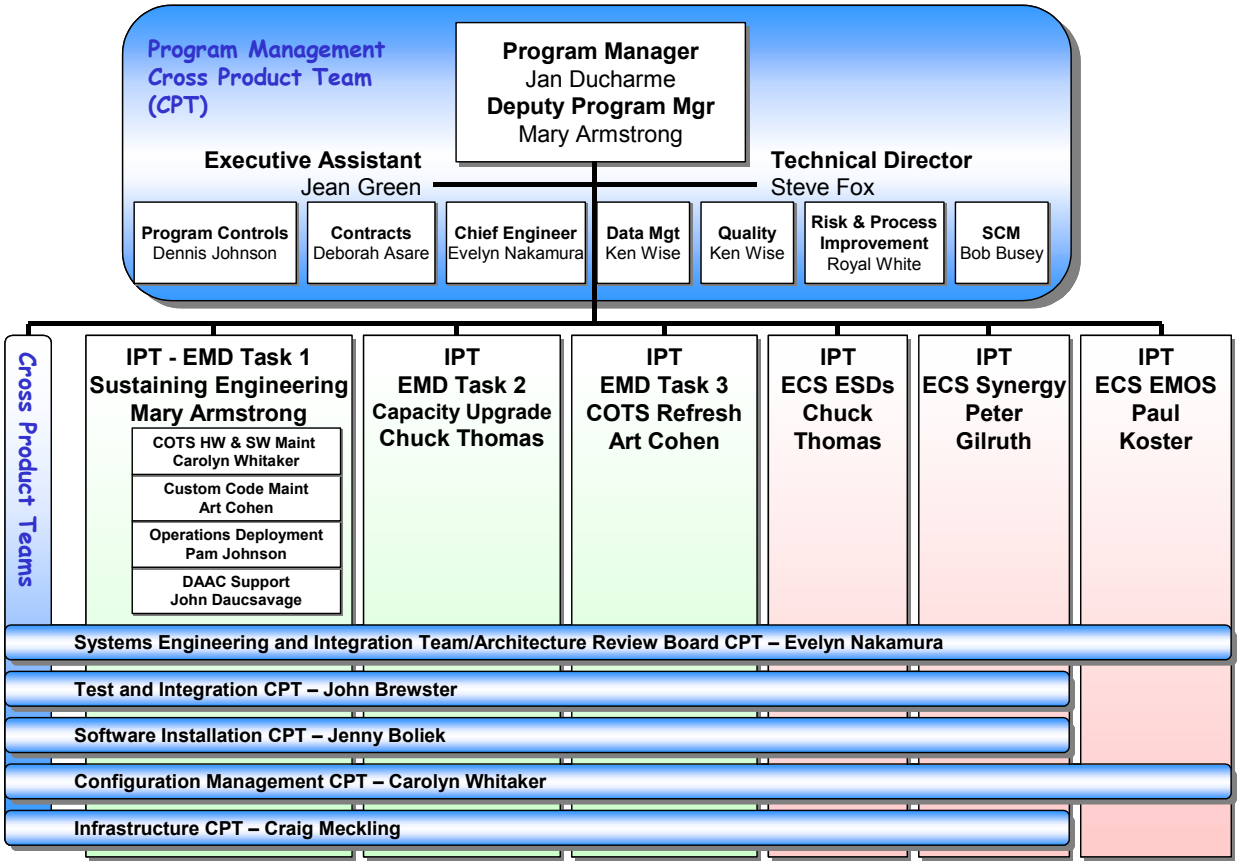


Figure 3.1.1-1. EMD Organization

The principal members of the Program Management Team (PMT) are the Raytheon Program Manager (PM), the Deputy Program Manager dual-hatted as the Task Leader (TL) for Task Order 101, the Technical Director (TD), the Chief Engineer (CE), Program Control, Supply Chain Management, Contracts, Risk and Process Improvement, Data Management, Quality Assurance, and the NASA ESDIS PMT.

The Task 101 TL is a key participant in the PMT and has direct access to all of the program level resources for support activities. Through the Custom Code, COTS Hardware and Software

Maintenance, Operations Deployment, and DAAC Support Teams, she has direct control of all of the technical disciplines required to deliver Task 101 services.

Raytheon brings system engineering and software maintenance experience to bear from our successful development, deployment, and maintenance of the ECS SDPS system. Our subcontractor team members have the following roles:

- **EDS** will provide support in the area of COTS procurement, logistics, property management, hardware integration and maintenance, and infrastructure support.
- **L3 Government Services (L3GS)** will provide support to the NASA science community in their use of ECS tools and software. They also support Science Data Processing Toolkit maintenance and training.
- **ATI** brings some of the most senior and proven ECS architects and software developers.
- **SGT**, **SSAI**, **ERT**, and **COMSO** are small business team members who bring on board expertise in software development, system integration and test, DAAC operations and support, material procurement, and earth science support.
  - SGT will provide computer infrastructure and test support, Verification Database (VDB) maintenance, and on site DAAC engineering support.
  - SSAI will provide test support and on site DAAC engineering support.
  - ERT will perform custom software maintenance and help desk support.
  - COMSO will provide COTS procurement support.

3.1.2 Staffing

The EMD Task Order 101 was principally staffed using ECS resources. Several Raytheon ECS personnel elected to re-badge with our new team members to achieve ESDIS small business goals. Except for on-site DAAC engineering, staff required for Task 101 will be collocated at our Raytheon Landover facility. This facility provides all of the resources (office space, computer equipment space, and support tools) needed to execute this task. Specific staffing status will be reported in the monthly Contractor Manpower report, DID# EMD-MCMR-12.

3.1.3 Work Flow Through Contractor Organization

Program Management has ultimate responsibility for all EMD Program activities. The team works closely with NASA counterparts to ensure that the activities and functions performed on the EMD Program are in line with the objectives of ESDIS. Within the scope of Task 101, work is performed based on four drivers:

- System Enhancement Proposals and response to Task Plan Requests
- Software COTS upgrade requirements to ensure that system software is maintainable
- Software Modification Requests based on trouble tickets and non-conformance reports (NCRs) from system users
- Hardware maintenance based on user trouble tickets

The workflow for each of these is described below, and is shown in Figure 3.1.3-1.

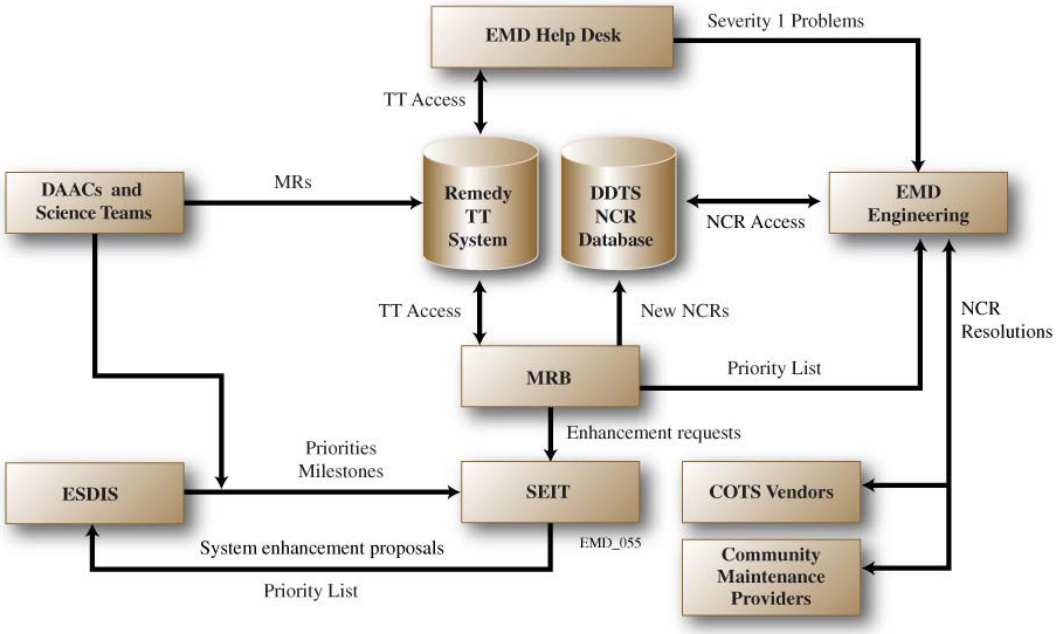


Figure 3.1.3-1. Work Flow.

System Enhancement Proposals and Response to Task Plan Requests

TASK ORDER PROCESS

EOSDIS submits a Task Plan Request (TPR) to implement change in the SDPS system that is a new or change in requirement.

EMD receives the TPR and assigns a Task Leader (TL) to develop a Task Plan Proposal.

The TL develops BOEs working with the technical leads for impacts associated with requirements, software development, maintenance, test, and support functions.

The results are reviewed and approved by Management. If approved, the proposal is forwarded to NASA.

NASA assesses the proposal. If approved, they forward a new Task Order or Task Order modification for implementation.

The EMD Program Manager (PM) directs the TL to implement the task.

Using the estimate, the new Task Order team plans detailed tasks in Primavera, assigned resources against the tasks, baselines the schedule, and assigns budget to the resources with assistance from the Support organizations.

When the Task Order is baselined, the EMD team briefs NASA on the plan, implements the work, and proceeds to brief project status as required in the Task Order.

When the Task Order is completed, the TL ensures all closeout requirements have been met, submits the necessary paperwork, and briefs the NASA Program Office.

Figure 3.3.1-2. EMD Task Order Life Cycle

When a Task Plan Request (TPR) is received for a new or change in an SDPS requirement, the Chief Engineer performs a quick analysis to determine if a more detailed analysis and assessment is warranted. Any requests that are rejected at this point will be reviewed with ESDIS and the submitter prior to closure.

The PM will assign a Task Leader (TL) to do the detailed assessment and estimation, including high-level operations concept and design, cost-benefit analysis, scheduling and resource identification. Pre-planning and detailed planning will use an EMD-tailored version of the Raytheon Integrated Product Development System process that has been used successfully on the ECS Project following approval by ESDIS to perform the work. The material included in a Task Proposal is forwarded to ESDIS after approval by Raytheon senior management and the EMD CCB. The Raytheon Team responds to TPRs within 25 calendar days. Emergency changes can be expedited.

Approved Task Proposals result in modifications to the EMD contract. Upon receipt of a new Task Order (TO) or modification to an existing TO, the TL begins detailed planning, including scheduling and resource identification. The SEIT reviews the plan to ensure that it reflects current EMD priorities and that it is consistent with the planned use of common resources such as integration and test environments.

During task execution cost and schedule specific metrics are collected and analyzed to track task progress by the task leader (see Section 3-12 for complete list of EMD metrics).

When a predetermined threshold is exceeded the metrics trigger management action. This might include resource, priority or schedule adjustments. At the completion of the task, the Task Leader ensures all close out requirements have been met and conducts a lessons learned session, if warranted.

Software COTS Upgrade Requirements

The COTS Software Maintenance IPT is responsible for continually monitoring vendor plans to determine the end of maintenance and end of life dates for each COTS product, as well as interdependencies between COTS products that would require multiple upgrades. Prioritization and planning of upgrades is performed by the COTS IPT, with review by SEIT, and is based on the overall risk to operations of allowing COTS versions to age. Resources to perform the upgrade are allocated primarily from the COTS IPT, but are also drawn from the Test and the Infrastructure CPTs. The number of upgrades to be performed per year is based on the complexity of each upgrade and the level of effort allocated to COTS upgrades under Task 101.

Custom Software Maintenance

Custom software maintenance activities are initiated by capturing and prioritizing modification requests from system users. The EMD Help Desk and SDPS Trouble Ticket system together provide the front line of support to system users. In addition, the SDPS NCR system, implemented with the Distributed Defect Tracking System tool (DDTS), is used by EMD engineers to identify problems found within the engineering environment.

After modification requests (MRs) have been captured, the Modification Review Board (MRB) assesses the impact of the reported problems and routes them for analysis by maintenance engineers. Each DAAC prioritizes outstanding MRs for work by EMD engineers and

communicates these priorities in weekly telecons that include ESDIS, the Deployment IPT, and SEIT. The Deployment IPT, with oversight by ESDIS and SEIT, develops a consolidated priority list that reflects the DAACs' individual inputs. The maintenance engineers within the Custom Code Maintenance IPT work on MRs in priority order to the greatest extent possible, given the resources and expertise available. The Operations Deployment IPT updates the EMD priority list each week and publishes the updated priority list to the DAACs and ESDIS.

After prioritization of MRs, work flows from maintenance engineers to the Software Installation and Test and Integration CPTs. This flow is described in more detail in Section 3.8, Technical Approach to System Development.

Hardware Maintenance

Hardware maintenance on EMD is primarily implemented through long-term maintenance agreements with hardware vendors (e.g., ADIC, SGI, Sun). As part of a contract package, service vendors include their corporate and EMD-specific maintenance and quality plans. The plans are integrated with and driven by overall EMD system maintenance plans and address preventive maintenance, diagnostics, corrective maintenance, customer service alert procedures, quality engineering, response time commitments, and escalation procedures.

At each site (DAACs, SMC, Landover facility), a Local Maintenance Coordinator (LMC) is designated, who coordinates day-to-day support with the site's operations management. It is the LMC who coordinates, and interacts directly with, the maintenance vendors. The LMC reports problems to the Landover facility, but is able to work with the maintenance vendors to resolve the problems immediately using Maintenance Work Orders (MWOs).

Maintenance records and metrics will be reviewed by the Failure Review Board (FRB), which includes representatives from SEIT, COTS Maintenance, Procurement, and ESDIS. The board meets bi-weekly, and reviews metrics, validates performance against availability (Ao) and mean down time (MDT) baselines per site and per function/thread, and recommends and/or initiates corrective measures.

3.1.4 Project Spending Rates.

Task 101 spending rates are projected below. Annual maintenance purchases are currently projected in the first month of the New Year; however, based on experience, these costs may actually occur in the last two months of the prior year. A detailed breakout of the cost and fee was included with the Task Plan Proposal. This spend plan is adjusted as new tasks are added to the contract.

Year & Month	TOTAL COST	SELL PRICE	Year & Month	TOTAL COST	SELL PRICE
2003 08	2,159,480	2,332,068	2005 02	1,877,061	2,026,711
2003 09	2,026,697	2,188,490	2005 03	1,917,269	2,070,006
2003 10	1,970,546	2,128,011	2005 04	1,870,719	2,019,878
2003 11	1,970,517	2,127,979	2005 05	1,878,740	2,028,518
2003 12	2,064,158	2,229,065	2005 06	1,925,074	2,078,426
2004 01	10,933,615	11,780,538	2005 07	1,874,671	2,024,125
2004 02	2,005,517	2,165,943	2005 08	1,700,667	1,836,170

Year & Month	TOTAL COST	SELL PRICE
2004 03	2,048,620	2,212,349
2004 04	1,999,151	2,159,077
2004 05	2,006,572	2,167,075
2004 06	2,056,713	2,221,068
2004 07	1,993,294	2,152,760
2004 08	1,792,803	1,936,067
2004 09	1,839,927	1,986,803
2004 10	1,794,609	1,938,004
2004 11	1,792,271	1,935,478
2004 12	1,876,074	2,025,763
2005 01	10,648,820	11,472,941

Year & Month	TOTAL COST	SELL PRICE
2005 09	1,741,429	1,880,026
2005 10	1,697,475	1,832,705
2005 11	1,691,599	1,826,360
2005 12	1,772,672	1,913,713
2006 01	10,745,171	11,576,180
2006 02	1,768,985	1,909,816
2006 03	1,806,142	1,949,819
2006 04	1,762,530	1,902,863
2006 05	1,760,356	1,900,511
2006 06	1,805,716	1,949,370
2006 07	1,761,544	1,901,789
TOTAL	94,337,211	101,786,466

3.2 Expanded Contract Work Breakdown Structure (CWBS)

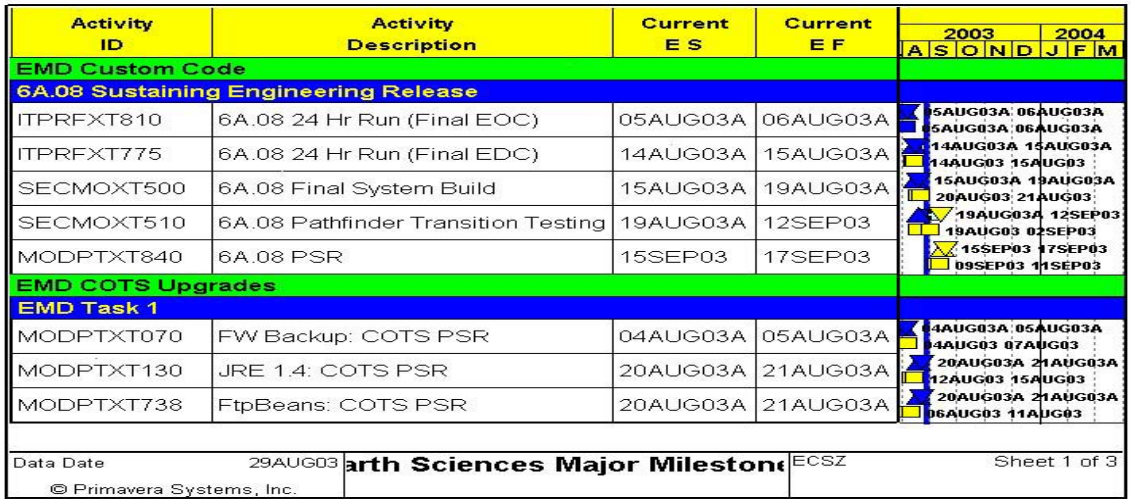
EMD Task 101 implemented the WBS structure as defined by NASA in the EMD RFP5-03186/179. The expanded CWBS is below.

WBS Structure			
LEVEL	**Task 101**		
Level 1	**01**	**Task 101 - ECS SDPS Maintenance**	**Control Account Monitor (CAM)**
Level 2	**0101**	**Program Leadership Team**	**Mary Armstrong**
Level 3	**010101**	Program and Task Management	Mary Armstrong
Level 3	**010102**	Program Controls	Dennis Johnson
Level 3	**010103**	Procurement	Bob Busey
Level 4	**01010301**	Supply Chain Management	Bob Busey
Level 4	**01010302**	Subcontractor Award Fee	Bob Busey
Level 3	**010104**	Configuration and Data Management	Carolyn Whitaker
Level 4	**01010401**	Configuration Management	Carolyn Whitaker
Level 4	**01010402**	Data Management	Ken Wise
Level 3	**010105**	Quality Assurance	Ken Wise
Level 3	**010106**	Property Management	Bill Wyman
Level 3	**010107**	Security	Carolyn Whitaker
Level 2	**0102**	**Transition**	**Mary Armstrong**
Level 3	**010201**	Transition Specific Program Management	Mary Armstrong
Level 3	**010202**	Transition Specific Technical Activities	Mary Armstrong
Level 2	**0103**	**Maintenance**	**Mary Armstrong**
Level 3	**010301**	Maintenance of Custom Code & Non-COTS related work	Art Cohen
Level 4	**01030101**	Maintenance of Custom Code	Art Cohen
Level 4	**01030102**	Custom Code Deployment	Pam Johnson
Level 3	**010302**	Maintenance of COTS Software	Carolyn Whitaker
Level 4	**01030201**	Maintenance of COTS Software	Carolyn Whitaker
Level 4	**01030202**	COTS Software Deployment	Pam Johnson

WBS Structure			
LEVEL	**Task 101**		
Level 4	**01030203**	COTS Software Material	Carolyn Whitaker
Level 4	**01030204**	COTS Software Infrastructure	Craig Meckling
Level 3	**010303**	Maintenance of Hardware	Carolyn Whitaker
Level 4	**01030301**	Maintenance of Hardware	Carolyn Whitaker
Level 4	**01030302**	Hardware Deployment	Pam Johnson
Level 4	**01030303**	Hardware Material	Carolyn Whitaker
Level 4	**01030304**	Hardware Infrastructure	Craig Meckling
Level 2	**0104**	**Development**	**N/A for Task 101**
Level 3	**010401**	Development of Custom Code & Non-COTS related work	N/A for Task 101
Level 4	**01040101**	Development of Custom Code	N/A for Task 101
Level 4	**01040102**	Deployment of Custom Code	N/A for Task 101
Level 3	**010402**	Development of COTS Software	N/A for Task 101
Level 4	**01040201**	Development of COTS Software	N/A for Task 101
Level 4	**01040202**	COTS Software Deployment	N/A for Task 101
Level 4	**01040203**	COTS Software Material	N/A for Task 101
Level 4	**01040204**	COTS Software Infrastructure	N/A for Task 101
Level 3	**010403**	Development for Hardware	N/A for Task 101
Level 4	**01040301**	Development for Hardware	N/A for Task 101
Level 4	**01040302**	Deployment of Hardware	N/A for Task 101
Level 4	**01040303**	Hardware Material	N/A for Task 101
Level 4	**01040304**	Hardware Infrastructure	N/A for Task 101
Level 2	**0105**	**System Engineering**	**Evelyn Nakamura**
Level 3	**010501**	Enhancement Engineering	Evelyn Nakamura
Level 2	**0106**	**Science Support**	**Art Cohen**
Level 3	**010601**	Science Support	Art Cohen
Level 2	**0107**	**Maintenance and Operations**	**John Daucsavage**
Level 3	**010701**	DAAC Operations Support	John Daucsavage
Level 3	**010702**	DAAC Training	Pam Johnson

3.3 High Level Schedules

An integrated master schedule will be maintained for EMD that depicts high-level milestones for each of the Tasks. The Primavera schedule included below shows an actual high-level schedule for Task 101 activities only. This schedule will be updated and briefed to ESDIS each week. As new tasks are added to the schedule, their milestones will be included in the high level schedule.



Activity ID	Activity Description	Current E S	Current E F
EMD Custom Code			
6A.08 Sustaining Engineering Release			
ITPRFXT810	6A.08 24 Hr Run (Final EOC)	05AUG03A	06AUG03A
ITPRFXT775	6A.08 24 Hr Run (Final EDC)	14AUG03A	15AUG03A
SECMOXT500	6A.08 Final System Build	15AUG03A	19AUG03A
SECMOXT510	6A.08 Pathfinder Transition Testing	19AUG03A	12SEP03
MODPTXT840	6A.08 PSR	15SEP03	17SEP03
EMD COTS Upgrades			
EMD Task 1			
MODPTXT070	FW Backup: COTS PSR	04AUG03A	05AUG03A
MODPTXT130	JRE 1.4: COTS PSR	20AUG03A	21AUG03A
MODPTXT738	FtpBeans: COTS PSR	20AUG03A	21AUG03A

In addition, a schedule will be maintained for each Task with all activities required to complete the work in the task. These schedules will be maintained in the EMD scheduling tool, Primavera Project Manager, and will be used by the IPTs to manage their work.

3.4 Progress Measurement and Reporting Plan

Raytheon measures progress by using earned value management (EVM) methodology against a well planned financial and schedule baseline, use of performance-based metrics, and a focused process improvement program to assess process performance on a regular basis.

- Although EVM is not a requirement on EMD, Raytheon is a strong proponent of this methodology for measuring a programs cost and schedule performance. It is not strictly necessary for a level of effort task, such as Task Order 1; however, it will be an effective tool for all end-item task orders such as Task Order 2 and 3, currently in review.
- Raytheon will be using a comprehensive set of metrics to ensure that EMD work is aligned with ESDIS goals and priorities. These metrics will enable Raytheon and ESDIS to evaluate and improve the quality, productivity, and effectiveness of products and services, and to measure the Raytheon team's performance on the program. These metrics are addressed in more detail in Section 3-12.

Raytheon reports progress on EMD tasks using the following forums:

- Program Management Review. On a monthly basis, we will provide a Program Management Review of the program's technical and financial status. This presentation will incorporate status on technical highlights for the month, system throughput by DAAC, data ingest, production, distribution trends, cumulative archive and inventory growth, average daily archive insert rates, and DAAC operations performance with current issues and problems being worked. The financial overview will address current program risks, resource management, and cost and schedule performance by Task Order.
- Daily Status Review. One day each week, we will provide technical status of progress, plans, and problems encountered for each task order. As new task orders are added, we

will increase the agenda and days a week to address their status. NASA involvement is encouraged.

- Informal Program Management Discussions. On a bi-weekly basis, the Program Management Team will visit with ESDIS Program Management to discuss vision, business issues, program priorities, and ongoing or potential concerns and possible solutions. This forum supports informal discussions and open dialogue.
- Raytheon also provides written progress to ESDIS through the use of the following monthly contract deliverable reports: Monthly Progress Reports, Contractor Cost Reporting – 533 Requirements, and Monthly Contractor Manpower Reports. We also address our performance at the conclusion of each award fee period through the submission of the Contractor Self Assessments due within a specified number of days following each period conclusion. We request a frank mid-term feedback discussion with ESDIS to determine whether our perspective of the period's performance is in line with ESDIS perceptions.
- On a weekly basis, Raytheon holds regularly scheduled teleconferences with each DAAC and ESDIS to discuss progress to operations goals, milestones, and any open issues or concerns they would like us to work. Similar teleconferences are held as necessary with the Instrument Teams to discuss new and modified Earth Science Data Types (ESDTs) and Product Generation Executives (PGEs), reprocessing campaigns, toolkit issues, and system enhancement requests.

3.5 Subcontract Management Plan

Functional Owner of the Process. The Raytheon IIS Vice President of Supply Chain Management (SCM) is responsible for Subcontract Management and Purchasing processes. These processes are implemented through a Supply Chain Management Integrated Program Team (IPT) approach, which is developed through the Integrated Product Development System (IPDS) process (see the SCM IPD-CMMI Matrix in "Attachments.") The IPTs report to the Landover, MD Site SCM Manager. The Supply Chain Management IPT members are collocated with the programs they support or are matrixed to them. IPT members may provide, as appropriate, material management, material cost control, material coordination, proposal support, and subcontract administration for the program. Each matrixed Supply Chain Management IPT member provides the focal point for coordination of procurement resources to complete program procurements on schedule and within budget. The allocation of direct material resources ensures the level of control needed to manage all aspects of the procurement process for the program.

Subcontract Management and Procurement Teams (SMPT) are also utilized within the program to help manage the interfaces for subcontracts, procurement and logistics efforts. For major subcontracts and procurements a Technical Program Lead may be part of the SMPT.

Subcontract Management. All EMD subcontracts are managed in accordance with published guidelines contained in the Supply Chain Procedures and Property Management Procedures. The Subcontract Administrator/Manager is responsible for monitoring every aspect of the subcontract to include planning, documenting, and tracking supplier performance. The Subcontract Management Team selects the best overall offer based on an assessment of the

supplier's understanding of the technical and contractual requirements; whether or not a proposal meets the full requirements of the Request for Proposal; risk; past performance; and cost/price.

Subcontract Award. At the conclusion of negotiations, and approval by both Supply Chain and Program Management, the subcontract is awarded to the supplier.

1. Each supplier is issued a unique, automatically generated, sequential subcontract number.
2. The subcontract is specifically tailored for inclusion of all Customer data elements, Statement of Work, CDRLS, and Specifications.
3. All data is shown on the subcontract including but not limited to part number, quantity, schedule, cost, terms and conditions, quality codes, etc. Detailed information, special instructions, and other requirements also are included in the subcontract vehicle.
4. The Terms and Conditions of the Prime Contract are flowed down to the lowest tier subcontractor.
5. Subcontract documentation is maintained in a uniform file format as mandated by the Supply Chain Procedures (SCPs), and is maintained in the subcontract administrator's office file. All complete/closed subcontracts are located in the Supply Chain central file room.
6. The Buyer/Subcontract Administrator maintains documentation related to the procurement. Safeguards in place allow only authorized subcontract personnel to modify the contractual data in any manner.
7. After award, the IIS Garland Data Warehouse provides the ability to generate information regarding the subcontract.

Subcontract Monitoring. Each subcontract differs based on defined areas, schedules, customer requirements, etc. Suppliers are monitored on cost and schedule performance to their original commitment. Monitoring consists of routine telephone calls, e-mail, formal Technical Exchange Meetings (TEM), Design Reviews, and Cost Performance Schedule Reviews (CPSR) at both the supplier and customer facility. Supplier progress on each item procured includes, but is not limited to, a review of adherence to quality requirements, completion percentage based on original schedule commitment, critical hardware and software deliveries, tests, key progress demonstrations, risk mitigation points, and cost incurred to date. Design Reviews and Technical Exchange Meeting minutes are the responsibility of the Program Manager. Copies are distributed to the IPT. Cost and Schedule variances to the original commitment are discouraged.

Consideration is only given for scope changes to the original requirement, delinquent source data and/or CFE/GFE. At a minimum, monthly supplier status reports are required from each subcontractor.

Subcontract Payments. Subcontracts are set up on a three-way match for payment processing. This means that in order for payment to be made, three detailed items must exist:

- Established order
- Receipt of the product being billed
- Approved invoice.

Invoices are reviewed for accuracy, including payments for milestone percentages as compared to the corresponding supplier status report. The subcontract administrator and program management office must approve all invoices prior to payment.

Only the Landover SCM Site Manager may approve payments that are exceptions to the three-way match. This may be done in instances when progress billings are required with final delivery of product at a later date.

3.6 Automated Project Management Tools

The following automated tools are used across the program:

Tool	Functional Area Supported	Description
ABC++	COTS	A custom Unix tool for extracting HTML and RTF documentation from C++ programs to generate documentation and facilitate browsing.
Acrobat Distiller	COTS	Used to convert files to pdf
Acrobat Reader	COTS	Used for reading pdf files
Aperture Auto CAD	COTS	Supports generation of PVC, VATC and DAAC floor plans
CDMTS/ECM	COTS	Foxpro based Change Management tool used to process and manage CCRs. Engineering Change Manager (ECM) is a planned web-based replacement to manage CCRs and MRs.
ClearCase BLM	COTS	Provides automated change management for 18 EBIS technical documents
Crystal Report	COTS	Used for Remedy reports development
DDTS	COTS	Used to support storage, update and reporting of NCRs. Provides customer access to all for NCR as substitute for an ECS CDRL.
DeliveryTool	COTS	Prepares and delivers all ClearCase custom code and delivers COTS S/W
ECS Assist	COTS	A custom tool for installing ECS software
FTP-32 Client for Windows	COTS	Used to transfer files from a PC to a Unix host and to a PC from a Unix host
GNU tar	COTS	A software archiving and extracting tool required for certain freeware and shareware products
ILM Tool	COTS	XRP-II based tool used to provide property management, license management, and maintenance work order tracking. Currently implementing ILM under Remedy.
MRTG	COTS	Multi Router Traffic Grapher tool used to monitor the traffic load on network links

Tool	Functional Area Supported	Description
PuTTY	COTS	A SSH, Telnet and Rlogin client for 32-bit Windows systems that provide a memory-resident agent not available with commercial secure shell. It is used to establish a secure connection between Remedy Admin PC and the Remedy Unix server
Rational Rose	COTS	A tool used for modeling object-oriented software
Remedy Action Request System	COTS	Used for trouble ticket reporting and reviewing. Current plans include using this for ILM.
S-Designor	COTS	A data modeling tool used in sustaining engineering of ECS databases
Snapshot v3.5.1	COTS	Unix application used to capture a pictures of GUIs with a menu pulled down on a Unix workstation for documentation purposes
Whazzup	COTS	A custom, system monitoring tool used to track the status of ECS modes and their custom code servers
WinZip	COTS	A PC based tool used for compressing and decompressing files
XV v3.0	COTS	Unix application used to capture pictures of GUIs on a Unix workstation for documentation purposes.
Excel	Deployment	Used in generating Sustaining Engineering Metrics and the OPS Priority List
MicroSoft Project	Deployment	MicroSoft Project is used to track day to day activities on small tasks
STTS	SW Development	An automated report that is generated each day for use in the daily merge meeting. It provides software merge information taken from the Software Turnover Tracking System (STTS) database. The report summarizes new merge form information that has been input into STTS within the past 30 days. The report is annotated in the merge meeting noting the merges that are accepted on any given day. The reports are kept in the merge log notebook kept in the functionality lab.
Purify	SW Development	Provides error and memory leak detection for Sun and Irix platforms. It identifies execution errors and memory leaks within applications in custom code, third party libraries and shared/system libraries.
RogueWave	SW Development	Rogue Wave software is a versatile C++ foundation class library, which is used throughout custom code. It provides single, multibyte and wide character support, time and date handling classes, multi-thread safe, generic collection classes, smalltalk-like collection classes.
DBX	SW Development	DBX is a very useful debugger for tracking down errors in our custom code. It is able to track the execution of the program line-by-line in the source code and report the status of every variable. Dbx is provided as a standalone binary for SGI and as part of the WorkShop package for Sun.

Tool	Functional Area Supported	Description
Java Runtime Environment(JRE)	SW Development	Offers a reliable environment for deploying Java applications in the enterprise. The Java Runtime Environment provides the minimum runtime requirements for executing a Java technology-enabled application.
Microsoft Access	Quality	Used to monitor and track the Landover Corrective Action Database; QA activity database (audits, evaluations and discrepancy reports) and the Corrective and Preventive Action Report (C/PAR) database.
Microsoft Excel	Quality	Used in generating Quality Assurance metrics for monthly reporting.
Common Network Tools	Test	System Activity Report, Show the Top Processes, Multi Router Traffic Grapher, Show network status, Show tape drive status
Scripts	Test	Ingest - prep_ingest, Ingest EOC_trickle, eoc_spec_verify, Collect_all_ Log_ Files, Vital_stats, WHAZZUP, ECS Distribution Metrics
Perl Scripts	Test	Mac to Mac Gateway order, SCLI Orders, Capture Performance Data
Product-Loadrunner	Test	Automation tool use for testing
MPM for Windows v. 2.1	Program Control	Primary financial database project control & EVM
Primavera Project Planner	Program Control	Project Scheduling
wInsight v. 5.0	Program Control	IFR, PMR, VARs, Earned Value Analysis
wInsight Administrator v. 5.0	Program Control	Administrator tool for wInsight
MPM Connect	Program Control	Used to transfer data from MPM to wInsight
Control 8	Program Control	Forecasting
JAMIS	Program Control	Timekeeping & Accounting query
Impromptu	Program Control	Tool used to extract JAMIS data from cost data warehouse (CDW).
Locally developed tools developed for ECS Program	Program Control	CSIP3 – Cost/Schedule integration tool for P3 & MPM, Validator Tool – Used to verify data consistency e.g. retroactive/current month change, actual costs with no baseline, etc., Sanitizer – Used to disguise subcontractor burdens in export data, and Crystal Report/Write – Adhoc reporting on MPM data.

3.7 Government Coordination

Customer coordination is paramount to the EMD Project Team. As indicated in Section 3.4, the Progress Measurement and Reporting Plan, NASA involvement with all aspects of the program is welcome, even encouraged.

3.8 Technical Approach to System Maintenance

The SDPS is just one part of the EOSDIS Ground Segment (EGS). Figure 3.8-1 shows the SDPS in context with the whole EGS.

The SDPS is the central data repository for the EOS Ground Segment. It is deployed at four Distributed Active Archive Centers (DAACs) located at: Goddard Space Flight Center, MD; Eros Data Center, SD; Langley Research Center, VA; and National Snow and Ice Data Center, CO.

The primary purposes of the SDPS are to:

- Provide data archiving and distribution capabilities for EOS Data.
- Generate science products from EOS observations.
- Accept science products produced by Principal Investigators and International Partners.
- Accept ancillary and supplementary data products for storage and distribution.
- Provide interfaces to instrument and interdisciplinary investigators' Science Computing Facilities (SCFs), which develop science data processing software and support scientific research.
- Interface with non-SDPS systems (e.g. the EOS Data Gateway) for customer search and order of data.

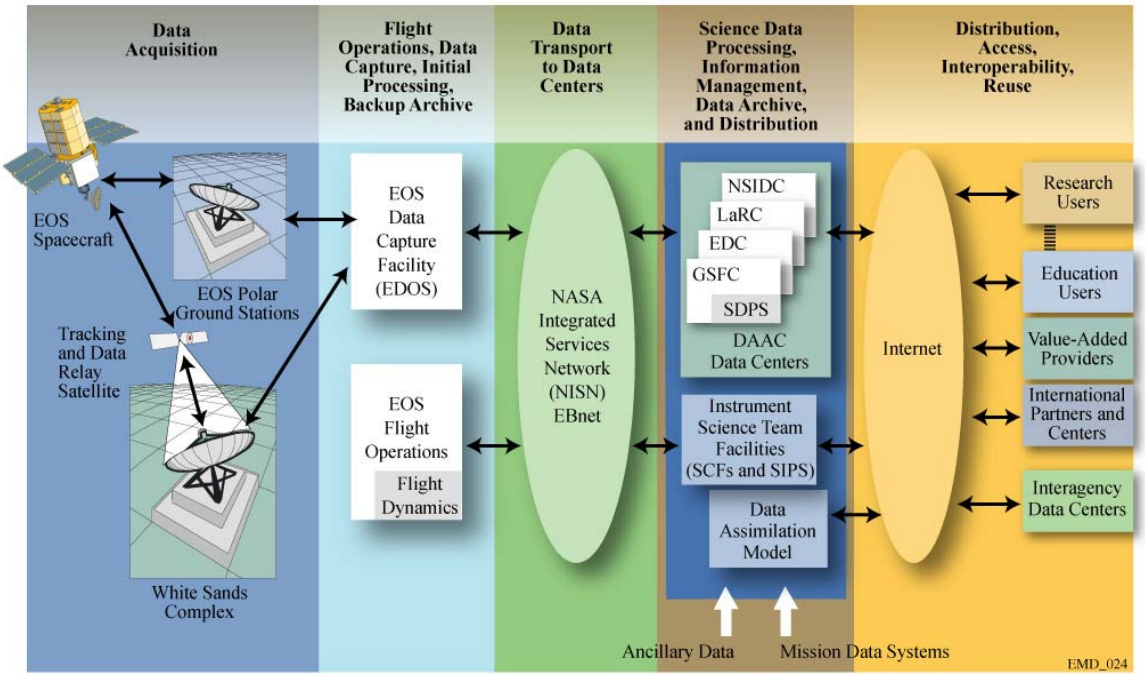


Figure 3.8-1. The EOSDIS System Context.

The current implementation of SDPS achieves these goals through the interaction of a number of subsystems as shown in Figure 3.8-2 and described below.

- ***Ingest.*** Provides the interfaces to external data providers. It is through the Ingest Processes that data is inserted into the SDPS.
- ***Data Server.*** Provides the core data services including data archive, storage and distribution management services as well as data inventory, data subscription and catalogue services.
- ***Data Management.*** Provides the data access interfaces to the various EOS access clients (e.g. EDG and ECHO).
- ***Planning & Data Processing.*** Provides the production services for those science products not generated at the SIPS or other external entities.
- ***Specialized Gateways.*** Provide custom access to SDPS data holdings (e.g. the ASTER DAR Gateway for On-Demand ASTER Acquisition and Processing, the Data Pool server for online access to popular or recently produced products).
- ***Management and System Monitoring Center (SMC).*** Provide management and support services.

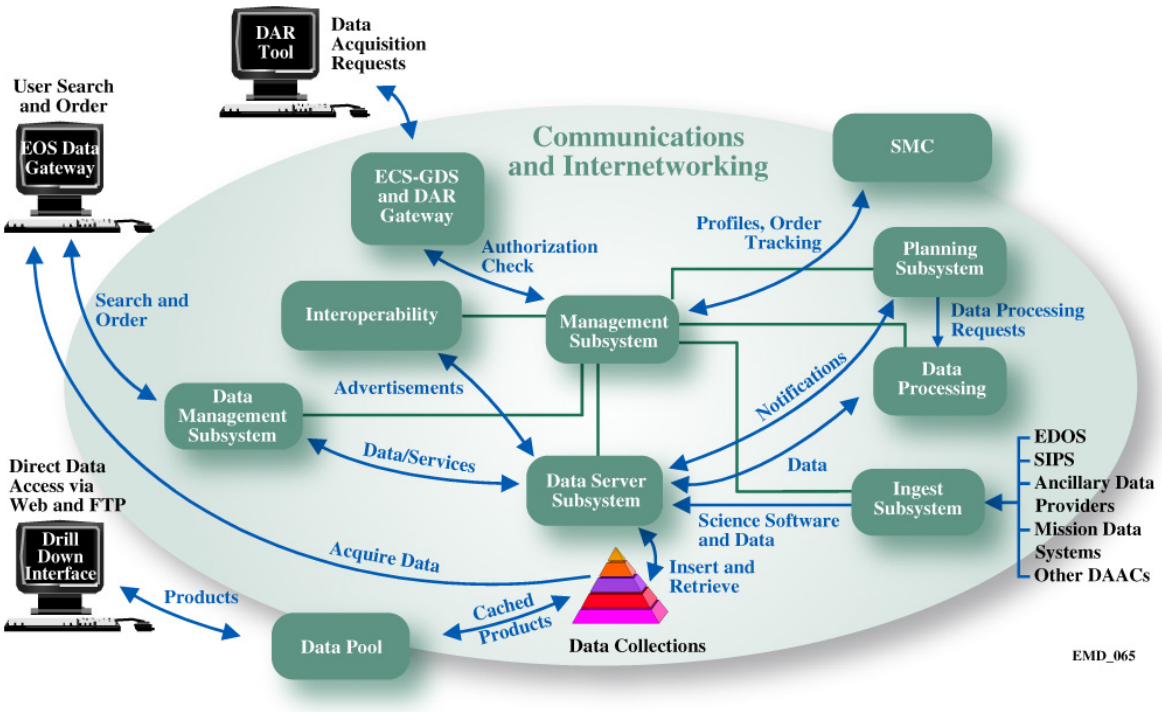


Figure 3.8-2. The SDPS Architecture

System patches to implement corrective, adaptive, and perfective maintenance are the primary output of EMD Tasks. The success of EMD is dependent on Raytheon's ability to plan and deliver patches that respond to operational needs and can be installed with minimal perturbation to operations. Patches are formulated in response to DAAC priorities and operational needs (see Section 3.1.3). Baseline management, software integration, and system testing are principal components of the development process.

Baseline Management for System Maintenance. An instance or snapshot of the complete system is referred to as a baseline. Separate custom software baselines may be defined to differentiate the system before and after changes are made to the custom software source code, isolating one baseline from the impact of the changes. Clearcase supports the ability to define and manage an almost unlimited number of software baselines, and maintaining multiple baselines increases flexibility in delivering fixes, however, each baseline supported requires significant resources: hardware and human resources in software CM to build and maintain the baselines; human resources to isolate, fix, test, document, and track separate fixes in multiple baselines; and human and hardware resources in the Software Integration Lab and the test environments (the PVC and VATC) to install, maintain, and test each baseline. This is why maintaining a separate code baseline for each DAAC, while offering some advantages, is economically impractical.

Typically Raytheon supports a development baseline, a maintenance baseline, and one or more engineering bug fix (EBF) branches as required. The development baseline will be used to integrate changes affecting a significant fraction of the system components and requiring lengthy

regression and performance testing; these types of changes generally will be driven by task orders for major new features and capabilities, and are expected to be infrequent under EMD. When work is completed on such a task, a new maintenance baseline is cut from the development baseline. During the period from the delivery of the new baseline to the last DAAC's installation of the new baseline (typically 45 to 60 days), the sustaining engineering group must provide maintenance fixes on both the new and the old maintenance baselines.

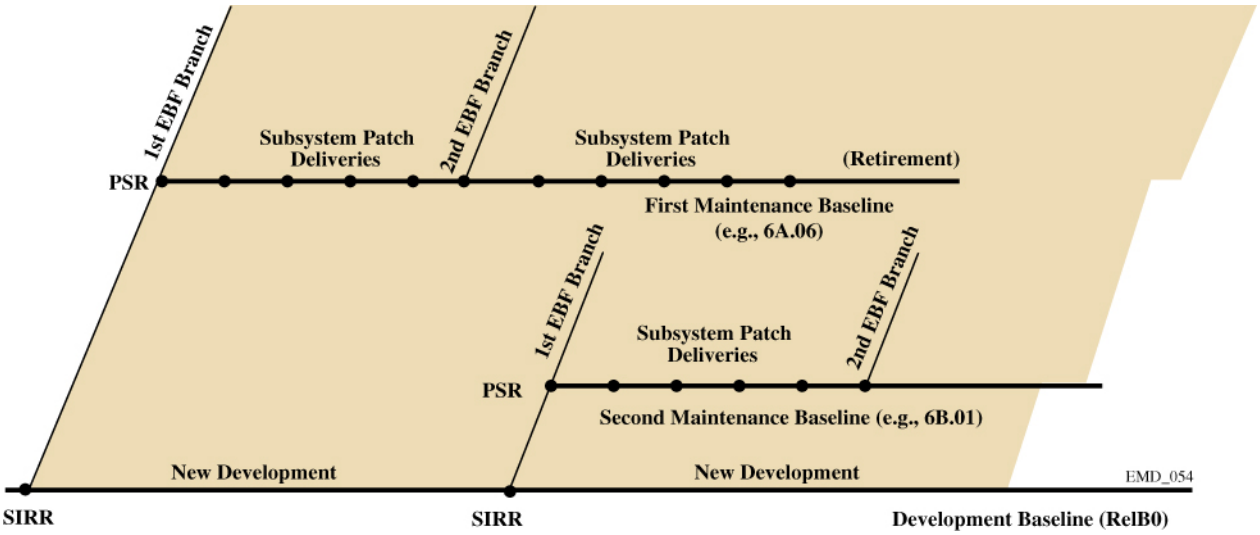


Figure 3.8-3. EBF Baseline Management

The EMD Team uses the ClearCase tool and well-established configuration management processes to implement support for multiple custom software baselines, enabling development of new capabilities in parallel with the delivery of small footprint changes to the field.

Developers use Clearcase to maintain multiple private views of the software, enforce module checkout and check-in rules, and manage the process of merging changes. When a developer has completed a fix in his or her view, he or she submits a Merge Request using the custom STTS tool. This tool maintains merge and build requests, routes them to appropriate reviewers, and tracks their completion. The lead engineer for the affected software subsystem will review and approve the Merge Request, or direct the developer to make necessary changes. If a merge must be made to multiple baselines, a Merge Request is submitted for each baseline.

The software integration management team holds a Merge Meeting each day, attended by the software subsystem leads, software CM, the Deployment Team, and the Test CPT Lead. The subsystem leads discuss the characteristics of each merge request: the baselines to which it will be merged, its impact on components outside the submitting subsystem, the changes it requires in installation or operation procedures, its need date and impact on the Monthly Patch Plan (DID #020, EMD MPP-20), and the test plan for verifying the fix. The request may be approved for merging that day, may be deferred until the completion of some other event (such as another merge or the creation of a patch file), or may be sent back for further re-work.

Once all Merge Requests are dispositioned, the builds are scheduled. The existing SDPS infrastructure will support the overnight build of two baselines; if merges of compilable code are approved for more than two baselines, the build of one or more baselines must be deferred, and the activities of all those affected must be adjusted accordingly. The Software Installation CPT decides which baselines will be built, balancing the needs and priorities of all of the baseline stakeholders.

Software Integration. The Software Integration Lab will provide a key resource for EMD software maintainers and developers. The lab provides multiple software instances of the full SDPS system, referred to as modes, implemented on multiple separate strings of hardware. The current lab in use under ECS will be consolidated into two hardware strings, each able to support three modes. The lab will be a shared resource, capable of running multiple software baselines. Each baseline typically will be allocated two or three modes so that multiple problems can be investigated independently and concurrently. The development baseline will be hosted in two or more modes whenever long term integration or development tasks are underway.

The Software Integration Lab will be used for debugging problems, testing fixes, integrating fixes at the subsystem and system level, and regression testing. The lab modes will be configured to execute the currently built baseline under software CM; this baseline will be refreshed automatically from the overnight builds. With the permission of the lab lead, developers will also be able to execute components of the system within a mode from builds performed in their personal views, so that they can compare baseline performance to the behavior resulting from their changes. The lab also will provide a collaborative environment where developers from one or more subsystems can work together to solve particularly complex problems.

The importance of having sufficient Software Integration Lab modes and lab resources to support all of the custom software baselines is another key lesson learned from ECS. If too many software baselines are created, the lab is unable to adequately support maintenance of all of the baselines simultaneously. The lab is managed by the software integration manager and staffed by experienced software integrators and troubleshooters.

The EMD Infrastructure CPT provides infrastructure services for the maintenance environment, such as incremental and full system backups, database administration, system administration, and implementation of approved upgrades.

System Testing. System testing occurs in the PVC and VATC at three levels: at the fix level, the TE or patch level, and the system level. Developers are responsible for testing their fixes; they do this by unit testing in private views, and by performing pre-integration testing (testing before a merge) in the Software Integration Lab. Once a fix has been merged and built, the developer is responsible for testing the fix again in the lab from the baseline build.

Once the delivery files for a TE or patch are created by software CM, the test organization installs the software in the sustaining engineering mode in the PVC; this mode is permanently allocated to the testing of sustaining engineering deliveries. Test executes the installation instructions provided with the delivery and provides redlines back to the software integration team, and performs verification testing on the NCRs fixed in the delivery. The test manager and the integration manager will discuss the scope of the changes provided in the delivery to identify any standard subsystem and full system regression tests that are necessary.

If a patch contains changes that could significantly impact system stability or performance, the patch will be installed in one of the two performance modes of the PVC. One performance mode of the PVC uses actual science granules, and tests the system with realistic data transfer loads; however, since it does not have as large a hardware suite as the largest DAAC, it cannot simulate a full transaction load. The second performance mode of the PVC is designed to execute a large number of requests per unit time; it uses tiny granules (100 kilobytes, versus 100 megabytes on average for real granules) so that actual data transfer times are negligible. The recent development of the tiny granules data sets and test procedures for ECS end of contract load testing has enabled the Raytheon Team to perform stress testing of the system at much higher loads in modes with only modest disk resources.

Software Quality Assurance (SQA). The EMD program will operate within an ISO 9001:2000 and AS9100 compliant Quality Management System (QMS). The Quality Assurance organization is responsible for ensuring adherence to QMS standards and procedures across the organization. Software Quality Assurance (SQA) activities, including quality engineering, verification and validation, nonconformance reporting, preventive and corrective action, software safety, and security assurance are ensured by the EMD Team via QAE auditing, monitoring, and direct participation or influence on process development and improvement. In addition to well-established documented processes, the QMS includes records of audits and related corrective action activities. Audit files and records are maintained and are available to the EMD Program for their review. Quality Assurance will develop and deliver a Software Quality Assurance Plan (DID EMD-SQAP-4) that further describes the organization and its activities.

3.9 Configuration Management Plans

The Configuration Management (CM) and Data Management (DM) organizations will report to the Program Manager (PM), and will provide services to the Maintenance Team and Systems Engineering and Integration Team (SEIT). These services will include, but are not limited to:

- Identification of all SDPS configuration-controlled items, including current version/release information for software and documentation.
- Management of a central CM/DM library and electronic repository, including physical and electronic retention and control of baselines for SDPS software, system hardware and software configurations, procedures, standards, and documentation.
- Implementation of an engineering release process for formal approval and CM release of all delivered SDPS software, hardware, and documentation.
- Configuration control and change management, including receipt, processing, review, disposition, implementation, and verification of baseline changes, including internal and external interface changes, establishment of a CCB, and management of changes flowing between the EMD and ESDIS CCBs. These changes may include Modification Requests (MRs) introduced as a function of EMD, as well as the standard Configuration Change Requests (CCRs).
- Status accounting and reporting of SDPS hardware and software information.

- Configuration audit and verification, including ensuring the integrity of hardware and software, as specified in controlled configuration documentation.

Our CM approach is based on the mature and proven ECS SDPS CM process with modifications that will be reflected in the EMD Configuration Management Plan (DID "EMD-CMP-19"). In meeting the requirements of the DID, the EMD Configuration Plan will document and address the following:

- Configuration Item (CI) Identification. The Configuration Management Plan will identify all of the EMD CIs. The Configuration Articles List (CAL) will be derived from the current set of ECS CIs, found in the ECS Baseline Information System (EBIS). Existing CIs will be reviewed, and based on ECS contract experience, may be modified to provide maximum cost benefit. Existing CIs that are not maintained and not used will be removed, while other items that were found needed, will be added.

- Consolidated Information Repository Management. Information consolidation will be provided using the Rational ClearCase CM tool. This tool will provide a common repository for all EMD program data, in order to have version-controlled information available for all customers. Also, this will provide the basis for continued process automation to support status accounting, auditing, and change management.

- Configuration Control and Change Management Documentation. The current Change Management tool, CDMTS, will be replaced by a new EMD Change Management tool. The new tool will provide change management for all CIs.

- Modification Requests (MRs) and Configuration Change Requests (CCRs) states will be visible upon query from the new EMD Change Management (ECM) tool. Consistent with the goal of a single, consolidated repository, the ECM tool will keep its records in the Rational ClearCase CM tool.

- Configuration Status Accounting and Reporting. With the advent of the new EMD Change Management tool's integration with the Rational ClearCase CM tool, real time configuration status accounting will be possible. Informational queries and reports will be accessible using the Web. The Configuration Management Plan will reference new process documentation and Users Guides to fully describe the methods for Status Accounting and Reporting.

- Configuration Verification Audits and Reporting. Interrogation scripts that were developed on the ECS contract will be maintained and used for EMD. Post processing scripts that were used to generate discrepancy reports and summaries will also be maintained and used. These will be machine scheduled to run once per week, and provide outputs on specific Web servers.

Process transition details will be provided within the Configuration Management Plan. The ECS Baseline Information System (EBIS) will become the EMD Baseline Information System (EBIS). Most ECS Baseline Information System Technical Documents that are not retired will easily transition into EMD Baseline Information Technical Documents. EMD Technical Documents will be managed using the Rational ClearCase CM tool.

The Configuration Management Plan will also provide references to Process and Work Instructions detailing the use of the ClearCase Baseline Management (BLM) tool, as well as the ClearCase Delivery Tool. The ClearCase BLM tool provides change control for most, but not all, of the Configurable Items. The ClearCase Delivery Tool provides consistent COTS and custom software preparation and delivery mechanisms. The new EMD Change Management (ECM) tool will complete the interface management of the CM tool suite.

The Configuration Management Plan will also specifically support training requirements. Training will improve the quality of information provided on MRs and CCRs, as well as improve communication between the Maintenance Team, SEIT, and CM. Process improvements and streamlining are only possible with effective communication and training.

Industry standards, such as the ISO 10007-1995 *Quality Management – Guidelines for Configuration Management*, will be referenced in the creation of the Configuration Management Plan, as well as concepts and practices of Software Engineering Institute's *Capability Maturity Model Integration (CMMI)*.

3.10 Risk Management Plans

Raytheon has a well-structured continuous risk management approach in place that meets the guidelines of NPG 7120.5A (see Figure 3-10-1). Risk factors have been an integral part of our planning process for system enhancements. Factors such as technical complexity, staff experience and availability, external dependencies, and COTS integration aspects are considered in costing and scheduling from the very start. As a result, potential risks are identified and addressed early in the process and tracked throughout the development process until they can be closed. This has led to substantial improvements in our cost, schedule, and technical performance on the ECS program over the last several years, as evidenced by the on-time and successful deliveries of 6A.05 (replacing DCE with sockets) and 6A.06 (upgrading to Solaris 8).

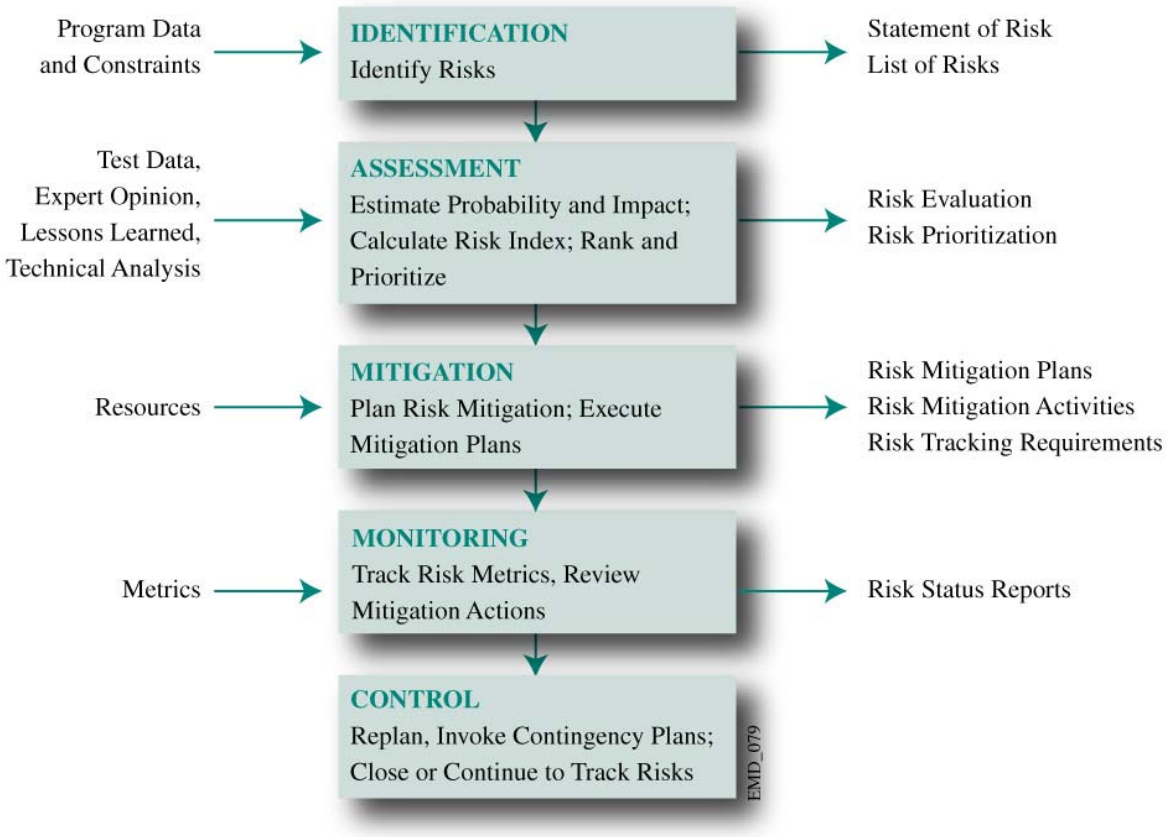


Figure 3.10-1. Risk Management Methodology

A number of risk mitigation strategies have been developed and implemented. Some of the strategies that have been incorporated in our processes include:

Spiral Development. One of the lessons learned on the ECS project was that it is sometimes difficult for the DAACs to judge the operational effectiveness of a new capability during requirements and design peer reviews. As a result, some new capabilities were deployed that required substantial rework. In order to reduce this risk in the EMD timeframe, the Raytheon Team proposes to add a spiral development process to its service offering. In this process, a subset of requirements is selected for initial design and implementation. The initial implementation is then deployed as a prototype to a pathfinder DAAC that has agreed to participate in early evaluation and feedback. The feedback is incorporated into the next design and implementation cycle, which improves the previous implementation and adds more requirements. Another prototype is deployed and more feedback is provided. This process continues until all requirements have been implemented. Each implementation cycle is typically short (2 to 3 months) with a 1-month evaluation period. The Raytheon Team has experience with this process having used it successfully on the ECS Project to develop the spatial subscription server component of SDPS.

ARB Reviews. Reviews of tickets and Planning Input Documents (PIDS) by the Architecture Review Board (ARB), include examination of risks very early in the planning stages for a new capability or enhancement. PIDs require that risks be identified and assessed for their potential impact (High, Medium. Or Low). The ARB reviews the PIDs to determine if all risks have been identified, assessed properly, and that the mitigation plans are appropriate.

Early PVC Testing. This strategy was employed, for example, in 6A.05 where, because the infrastructure was so dramatically changed, the potential risk for breakage due to load stress on the system was recognized early. Provisions were made for early PVC stress testing which rooted out software problems early in the release cycle.

DSR. This weekly review ensures that PMT and ESDIS are aligned and understand the technical issues. This forum offers opportunities to discuss detailed actions to ensure risks are being mitigated.

3.11 Security Management Plans

EMD System Security will continue the high precedent established with ECS. The security program will be implemented and maintained in accordance with 423-10-23, EOSDIS Security Policy and Guidelines Document, and NPG 2810.1, Security of Information Technology. The security program will also address the guidance provided in Section 2.7.6 of the Task 101 SOW. Security responsibility rests with the SDPS computer security officer (CSO), who is a member of the SEIT. The CSO will be responsible for ensuring that all aspects of the SDPS security requirements are met.

Security activities will continue to be led by Raytheon with an emphasis on consensus with the DAACs. DAAC security administrators, ESDIS security staff and EMD security staff will continue this exchange through active working groups. The implementation of a security activity is the responsibility of the DAACs with guidance or assistance provided as required from EMD program security staff. EMD personnel will be responsible for security changes at the EDF and SMC. Biannual security scans by the ESDIS IV&V at the DAACs and at the EDF will continue to be supported. Security efforts will not be limited to maintaining the current posture, but will be directed toward continuously improving the security posture of EOSDIS assets.

EMD physical, personnel, information, communications, and IT security represent special concerns that justify their own suite of documentation. While security responsibility is that of the CSO, all offices or organizations of the EMD project must be sensitive to security issues. The major project documents associated with EMD security are:

- EMD Security Management Plan (DID #007, EMD-SMP-7)
- EDF Risk Management Plan
- Contingency Plan for the EDF

The DAACs are responsible for their corresponding Risk Management and Contingency Plans. The EMD Security Plan promulgates the overall EMD security policies and will include, but not be limited to, discussions of the following areas:

- SDPS Security Architecture. The SDPS security architecture evolved from a three-layer architecture to its current four-layer architecture with the implementation of the Perimeter Services provided by the high-performance Portus ES proxy firewalls. The four-level architecture includes border services, perimeter services, enterprise services, and host services. We will continue to evolve the SDPS architecture as necessary to maintain the current levels of protection, as well as to react to changes in the network security environment.
- Security Engineering Processes. EMD security objectives will be to maintain and upgrade the security features of SDPS hardware and software to assure the system's integrity and to protect its data holdings. SDPS security engineering personnel will continue to interface with NASA, ESDIS, and the DAACs on security issues, while maintaining the integrity of the PVC, VATC, and the SMC. The DAACs will be responsible for their own security under EMD, with the assistance and guidance of the EMD CSO. EMD security engineering processes include the following:
  - System/Security Patch Management
  - Technical Security and Information Working Group (TSIWG)
  - Support Vulnerability/Risk Management
  - Security Alert Monitoring
  - Security Incident Notification
  - Firewall Support and Maintenance
  - Security Training

3.12 Performance Metrics Plans and Requirements

On EMD, Raytheon will use performance metrics as a means of determining whether the program is meeting its goals and requirements. Raytheon anticipates that these metrics, as well as other information, will be used by ESDIS in measuring program performance. Raytheon has developed metrics in response to specific program goals that were determined in conjunction with ESDIS. While the goals are expected to be constant across the program, it is possible that the metrics may be refined over time, either by improving the formula for measurement, or by changing the thresholds for performance. For instance, Raytheon's ability to respond to priority NCRs is based on the complexity of the NCRs, and it has been our experience that enhancements are more complex to resolve than problems with existing functionality. As the number of enhancements on the priority list increases, Raytheon may be less able to quickly resolve priority list issues.

Some program metrics are dependent both on Raytheon performance and on that of the DAAC operation contractors (shown as "shared" in Table 3.12-1). For instance, a DAAC may decide to perform less distribution because it is engaged in a specific reprocessing campaign. Operations specific issues must be taken into consideration in the evaluation of these metrics.

Program goals and their specific corresponding metrics to be provided to NASA are contained in Table 3.12-1.

Table 3.12-1. EMD Program Management Metrics

Goal: Higher priority problems receive more attention than lower priority problems	**Excellent**	**Nominal**	**Marginal**
• Metric: Average number of days from inception to delivery for Severity 1 NCRs over the last 3 months for Engineering Software or Test Executables	1-2	3-5	>=6
• Metric: Average number of days from the priority date to delivery for Top 25 NCRs (Test Executables or Patches)	43-55	56-80	>=81
• Metric: Average number of days from the priority date to delivery for Top 75 NCRs (Test Executables or Patches)	50-65	66-93	>=94
• Metric: % of all NCRs fixed that are from the program priority list	65-75	50-64	<=50
• Metric: % of total number of hours spent fixing NCRs from the program priority list	85-90	75-84	<=74
Goal: Sustaining engineering efforts are aligned with mission goals			
• Metric: % of planned EMD mission-related milestones achieved during the month	90-100	80-89	<=79
Goal: Maintenance costs are being reduced			
• Metric: Task schedule performance vs. plan (for scheduled enhancements)	*To be determined by Task based on overall Task schedule*		
• Metric: Task cost performance vs. plan	Within 1% of Task cost	Within 10% of task cost	< 10% of task cost
Goal: DAACs are achieving required workloads			
• Metric: Number of data granules and volume ingested at the DAACs vs. program requirement (Shared responsibility with DAAC)	Meets/ Exceeds F&PRS		Does not meet F&PRS
• Metric: Number of data granules and volume distributed at the DAACs vs. program requirement (Shared responsibility with DAAC)	Meets/ Exceeds F&PRS		Does not meet F&PRS
• Metric: number of data granules and volume produced at the DAACs vs. program requirement (Shared responsibility with DAAC)	Meets/ Exceeds F&PRS		Does not meet F&PRS

Raytheon will deliver these metrics as part of its Monthly Progress Report, DID #010 EMD-MPR-10, and will brief them to ESDIS to ensure that they receive adequate visibility and discussion.

3.13 Property Management

DID EMD-PP-5, Property Management Plan, and its companion NASA Procedures and Guidelines (NPG) 4200.1E, Equipment Management Manual, define the minimum content of the plan by which the Raytheon Team will provide property management services for the EMD SDPS at the EMD DAACs, the SMC and the Raytheon Landover Maintenance Facility. The current Property Management Plan for the ECS Project, 602-CD-001-004, June 2002, has been reviewed and already meets the requirements of EMD-PP-5. The Property Management Plan for the ECS Project addresses management of ECS Contractor-acquired commercial off-the-shelf (COTS) hardware and software and government-furnished property (GFP), including management of Contractor-acquired property and GFP in which the ECS Contractor has direct maintenance responsibility, until NASA accepts it.

Documented process instructions and work instructions are in place requiring minor updates to accommodate changes required by EMD contract. At a minimum, the following project

instructions are immediately applicable to implementing the strategies, direction and actions specified in the Property Management Plan: COTS Product Receiving, Inspection and Verification Procedures (IL-1-001), ILS Facility Planning and COTS Hardware Installation (IL-1-002), Control of ECS Property at Remote Sites (IL-1-005), COTS Software License Administration (IL-1- 006-1), COTS Maintenance Support (IL-1-006), ECS Electrostatic Discharge (IL-1-007), Maintenance Data Collection System (IL-1-010), and COTS Procurement (SE-1-027).

The existing ECS Property Management Plan will be updated to support EMD Property Management requirements not later than December 1, 2003. Minor updates will be made to the organizational and roles and responsibility sections to ensure compliance with the proposed task-oriented and functionally distributed organization of the EMD contract. Additionally, specifics of contractor accountability for Government Property, per Section G.9 of the RFP, and NASA requirement for quarterly NF 1018 reporting will be incorporated.

The Raytheon property management data system (Integrated Logistics Management-ILM) integrates inventory management, maintenance management and license management into one system. This promotes synergy among property management functions.

The Raytheon team will continue to use causative research techniques to research inventory discrepancies. Use of this technique prevented $1.1M of losses to ECS property.

The Raytheon solution continues to use trained Raytheon Team personnel who understand NASA property management requirements. Following Raytheon Property Control Procedures as defined in the ECS Property Management Plan and the complementary ISO 9001:2001-based project instructions, the Raytheon Team has never failed to pass the annual Defense Contract Management Agency (DCMA) Government Property Control Systems Analysis (PCSA). Conducted in accordance with DOD Manual 4161.2-M and FAR Part 45, this DCMA "audit" on behalf of NASA has repeatedly attested to Raytheon's satisfactory system for the management and control of Government property.

Execution and Metrics. The Property Management Plan, and its complementary ISO 9001:2000-based PI's, will guide the EMD Team in performing EMD property management functions. The Property Management Plan will document procedures as required by FAR 45-5 and NASA FARSUP 1852.245 in the following areas: general property management techniques; acquisition; receiving including receiving inspection, receipt processing, and receipt reporting; identification; records; property management system; movement, including intra-site relocations, inter-site relocations, external transfers and off-site vendor repairs; storage; physical inventories; reports, including quarter reporting and annual reporting; consumption to include reporting loss, damage or destruction of EMD property, utilization to include consumables and control of pilferable material; maintenance, including warranty management and recording maintenance actions; subcontract and vendor control; disposition, including government furnished property and reporting excess government property; and property closeout.

Work will be performed primarily at the Raytheon Landover Maintenance Facility specific to all GFP at the ECS DAACs, the SMC and the Landover Maintenance Facility. It is assumed that the operations contractors at the DAACs will perform their property custodian responsibilities

per the EMD Property Management Plan (the document that is under ESDIS and DCMA approval).

The following metrics will be used to assess performance in the property management function:

- Processing timeliness for receipts and shipments. Goal 1 day for both actions.
- Dollar value of material lost damaged or stolen. Goal loss of less than 0.05 percent of total dollar value of inventory. This goal refers to losses that could have been prevented by the Raytheon Team due to poor record keeping and/or mishandling of material. The Raytheon team achieved this goal in the ECS contract.

3.14 Science Support

The EMD Team will provide science support in two primary areas: Earth Science Data Type (ESDT) maintenance and science user support.

ESDT Maintenance. The EMD Team will continue support for ESDT updates. SDPS uses ESDTs to define the metadata for the data products that it receives and distributes. Raytheon currently maintains over 2,800 ESDTs, consisting of over 9 million lines of ODL code. The Science Team will continue efforts to develop Web-based applications that allow creation of ESDT supplementary data. The Team will also continue to work with GCMD, the Instrument Teams (ITs), and the DAACs to keep valid values up to date and consistent with the GCMD. Experience gained from generating the Terra, Aqua, and Aura ESDTs will continue to help the ITs improve their metadata on current and future data types. The modification of existing ESDTs and the creation of new ESDTs will continue to be managed using the custom software maintenance and development processes.

As part of ESDT maintenance efforts, the EMD Science Team will continue to work with the ITs and science teams to define content and parameters for new ESDTs that build upon the scientific community's efforts to standardize digital geographic information. Additionally, the EMD Science Team will help the science teams and ITs to maintain consistency in the valid values related to new ESDTs. The objectives of these efforts will be directed toward increasing the availability, access, integration, and sharing of geographic information throughout the science community.

The EMD Team will continue to provide classroom and hands-on ESDT training to ITs, including instruction on the EOSDIS data model, the ESDT definition process, and metadata requirements and options. Comprehensive training will be scheduled at least once per year and will be open to the science community and the DAACs. Alternately, the training can be delivered in specially scheduled sessions so that we can adapt the content to the experience level of the audience. For example, training sessions can be scheduled following changes in personnel or contractors that support the ITs or DAACs. The training will be modified each year, as mission needs change. The EMD Team will be able to quickly make these changes because of our knowledge of and interaction with the science community.

Science User Support. The EMD Team will develop and maintain interface documentation between ECS SDPS and each of the supported ITs. These efforts will be driven by the addition of new data types and through facilitated changes in metadata. The EMD Science Team will

employ systems engineering methodologies ranging from interviewing EMD personnel and IT principal investigators to preparing draft and final Interface Control Documents for approval. The EMD Team will also periodically review the data model so that it remains current with on-going missions and flexible to support future missions.

The EMD Team will prepare technical assessments of the QAPs developed by the instrument teams (ITs). The EMD Science Team will employ experience gained by support of past EOS missions to evaluate QA processes and schedules, and prepare a summary of findings and recommendations. Because of the diversity of IT products, tools, and locations, quality assessments will be tailored to the specifics of each IT. The EMD Team will also continue to support the QA Working.

The EMD Team will serve as a technical liaison with each of the ITs regarding modifications and/or extensions to SDPS. Personnel assigned as liaisons will know the IT's mission, goals, schedule, and issues, and will be knowledgeable of SDPS. Duties will include coordinating with the ITs and science teams to assess proposed modifications, and to communicate about upcoming SDPS and IT goals and milestones. Technical issues will be discussed with the ITs and science teams and resolved before submitting a proposed modification to the formal MR process. The Team will also refine proposed modifications to ensure that the action required, and the probable results, are clearly articulated and understood before proceeding.

The EMD Team's data specialists and software engineers will investigate PGE system interface problems at the DAACs related to both performance and system failures. PGEs are computer processes used to generate standard products from data received from science instruments. Analyses will include the EMD environment in which the PGE runs and the input files being used for operational processing. Problems may relate to the PGE directly, or to external factors such as the EMD code in which the PGE is running. The EMD Team will integrate selected PGEs with SDPS to support performance and stability testing. The Team will also use knowledge gained from integrating the PGEs to keep test procedures up to date.

3.15 Other Plans

Corporate Best Practices. To perform the requirements for EMD, the team will draw from an established process framework that draws from Raytheon's IPDS, ISO 9001:2000 Quality Management System, and ongoing software process improvements sponsored by Raytheon Engineering and Raytheon Six Sigma.

- **IPDS.** The IPDS model enforces Raytheon's mandate to use common, integrated product development processes when planning, managing, and executing programs. IPDS provides a common system of flexible, comprehensive processes tailored to meet the requirements of each program, project, or task. The EMD Team brings legacy processes developed jointly on ECS with NASA over the past several years. Using IPDS, they will be tailored appropriately to augment the EMD program's management processes.
- **Raytheon Six Sigma.** Raytheon Six Sigma is the knowledge-based process the team will use to spearhead continuous process improvement throughout the organization in order to maximize customer value. EMD team members are chartered to find and eliminate waste and defects using the tools and analysis provided by Raytheon Six Sigma. Raytheon Six Sigma is comprised of three essential components: emphasis on customer focus, the

culture of process improvement and teamwork, and the use of specific tools to apply to the analysis and implementation of improvement activities.

- **ISO 9001:2000. ISO 9001.** Raytheon processes and practices are ISO 9001:2000 and AS9100 compliant. At the program level, specific Project and Work Instructions, already proven effective on ECS SDPS, will be transitioned and updated, as needed, to serve the EMD Program.